

1 **CLAIM AMENDMENTS**

2 **Listing of Claims:**

3 **What is claimed, is:**

4 1. (original) A method comprising employing a vocabulary of color names in assigning a color
5 name to a pixel in a digital representation, including the steps of:

6 providing said vocabulary of color names with a plurality of color prototypes, each said
7 color prototype having a prototype color name and a corresponding prototype color value;

8 comparing a pixel color value of said pixel to said prototype color value of each color
9 prototype in the vocabulary, and obtaining a color match value for said each color prototype in
10 the vocabulary;

11 determining a closest color match value resulting from said step of comparing; and

12 assigning to said pixel a particular prototype color name corresponding to said closest
13 match value.

14 2. (original) A method as recited in claim 1, further comprising forming said vocabulary of color
15 names, includes the steps of:

16 obtaining at least one general set of essential color names, each essential color name
17 having a corresponding color value;

18 whereby each color name includes a hue descriptor, brightness modifier, and saturation
19 modifier; and

20 selecting a subset of said at least one general set in meeting an application desire for said
21 vocabulary of color names.

22 3. (currently amended) A method as recited in claim 2, wherein the step of obtaining includes
23 starting with a large number of arbitrary color names having corresponding color values and
24 modify them said color names through subjective (~~perceptual~~) experiments to obtain a general set
25 that models human behavior in color naming.

1 4. (original) A method as recited in claim 1, wherein the step of comparing includes the steps of:
2 computing a color distance in a selected color space between the color value of said pixel
3 and said prototype color value;
4 finding the closest perceptual match to the prototype color value for said color distance;
5 computing an estimate value of perceptual dissimilarity between said closest perceptual
6 match and color value of said pixel; and
7 using said estimate value to modify said color distance, thereby obtaining said color
8 match value.

9 5. (original) A method as recited in claim 1, wherein the step of determining includes finding the
10 prototype color value having the minimum color naming distance to the color value of said pixel.

11 6. (original) A method as recited in claim 1, further comprising:
12 acquiring a digital representation of a scene;
13 employing said vocabulary in providing a description of a color composition in said
14 scene.

15 7. (original) An article of manufacture comprising a computer usable medium having computer
16 readable program code means embodied therein for causing assignment of a color name, the
17 computer readable program code means in said article of manufacture comprising computer
18 readable program code means for causing a computer to effect the steps of claim 1.

19 8. (original) A program storage device readable by machine, tangibly embodying a program of
20 instructions executable by the machine to perform method steps for assigning a color name, said
21 method steps comprising the steps of claim 1.

22 9. (original) An apparatus comprising means for employing a vocabulary of color names in
23 assigning a color name to a pixel in a digital representation, including:

1 means for providing said vocabulary of color names with a plurality of color prototypes,
2 each said color prototype having a prototype color name and a corresponding prototype color
3 value;

4 means for comparing a pixel color value of said pixel to said prototype color value of
5 each color prototype in the vocabulary, and obtaining a color match value for said each color
6 prototype in the vocabulary;

7 means for determining a closest color match value resulting from said step of comparing;
8 and

9 means for assigning to said pixel a particular prototype color name corresponding to said
10 closest match value.

11 10. (original) An apparatus as recited in claim 9, further comprising

12 means for forming said vocabulary of color names, including:

13 means for obtaining at least one general set of essential color names, each
14 essential color name having a corresponding color value;

15 means for whereby each color name includes a hue descriptor, brightness
16 modifier, and saturation modifier; and

17 means for selecting a subset of said at least one general set in meeting an
18 application desire for said vocabulary of color names.

19 11. (original) An apparatus comprising:

20 means for obtaining a vocabulary of color names;

21 means for acquiring a digital representation of a scene; and

22 means for employing said vocabulary in providing a description of a color
23 composition in said scene.

24 12.. (original) Apparatus as recited in claim 11,

25 wherein the means for providing includes means for employing color names in describing
26 the scene and in describing objects in said scene.

1 13. (original) A computer program product comprising a computer usable medium having
2 computer readable program code means embodied therein for causing assignment of a color
3 name to a pixel in a digital representation, the computer readable program code means in said
4 computer program product comprising computer readable program code means for causing a
5 computer to effect the functions of claim 9.

6 14. (original) A computer program product comprising a computer usable medium having
7 computer readable program code means embodied therein for causing provision of a description
8 of a color composition in a scene, the computer readable program code means in said computer
9 program product comprising computer readable program code means for causing a computer to
10 effect the functions of claim 11.

11 15. (original) A method comprising:
12 obtaining a vocabulary of color names;
13 acquiring a digital representation of a scene; and
14 employing said vocabulary in providing a description of a color composition in said
15 scene.

16 16. (currently amended) A method as recited in claim 15, further comprising at least one
17 limitation taken from a group of limitations consisting of:

18 wherein the step of providing includes employing color names in describing the scene and in
19 describing objects in said scene;

20 wherein the step of employing includes:

21 computing a simplified representation of said scene to model a human perception of said
22 scene;

23 segmenting a digital image representing said scene into a set of meaningful regions;

24 computing a perceived color value for each said meaningful region;

assigning a region color name from said vocabulary to each said meaningful region;
using said region color names to describe the color composition of said scene at different
accuracy levels;

further comprising computing a simplified representation of said scene corresponding to a human
observation of said scene;

wherein the step of computing a simplified representation of said scene includes:

applying a chromatic transformation to accommodate for a particular illumination
condition of said scene;

labeling said each pixel in said image with a label of a descriptive type to correspond with
the descriptive type of an element of said scene to which said each pixel belongs;

performing adaptive smoothing of said image with an amount of smoothing around said
each pixel in correspondence with the descriptive type of said each pixel;

for said each pixel , determining whether said each pixel is a perceptually significant
pixel or a perceptually insignificant pixels; and

reapplying chromatic transformation to preserve a color appearance as perceived in said
human observation;

wherein the step of labeling includes:

determining if said each pixel in said image represents an edge;

estimating distribution of edge density in a neighborhood of said each pixel in said image;

and

using said distribution to determine a descriptive type of said each pixel and labeling said
each pixel accordingly;

wherein the descriptive type includes a type taken from a group of types including: uniform,
noise, contour, region boundary, texture boundary, transition region, coarse texture, and fine
texture;

1 wherein said step of determining includes deeming said each pixel to be perceptually significant
2 if said each pixel is at least one of: uniform, in a dominant object, in a dominant background,
3 coarse texture and fine texture;

4 wherein said step of determining includes deeming said each pixel to be perceptually
5 insignificant if said each pixel is at least one of: noise, contour, region boundary, texture
6 boundary, and transition region;

7 wherein the step of labeling produces a label for said each pixel, and the step of smoothing
8 includes:

9 obtaining the label for said each pixel in said image; and
10 using said label for said each pixel in determining a smoothing filter to be used for said
11 each pixel in said image;

12 wherein the step of smoothing is performed only on perceptually significant pixels;

13 further comprising changing said smoothing filter depending on a particular descriptive type of a
14 particular pixel in a center of the smoothing filter;

15 wherein said support of a smoothing filter is largest for pixels labeled uniform and smallest for
16 pixels labeled coarse texture;

17 wherein the step of segmentation includes at least one of the following: color segmentation,
18 texture segmentation, region growing, region merging, region splitting, multiresolution
19 segmentation; and

20 wherein the step of computing a perceived color value for a meaningful color region includes:
21 changing a pixel value of each perceptually insignificant pixel in said region into a new
22 value equal to the pixel value of a closest perceptually significant pixel from said region;
23 and

1 averaging color values of all pixels in said region.

2 17-28 (canceled)

3 29. (currently amended) A method as recited in claim ~~17~~ 16, wherein the step of assigning
4 includes:

5 providing said vocabulary of color names with a plurality of color prototypes, each said
6 color prototype having a prototype color name and a corresponding prototype color value;

7 comparing said perceived color value of each said meaningful region to said prototype
8 color value of each color prototype in the vocabulary, and obtaining a color match value for said
9 each color prototype in the vocabulary;

10 determining a closest color match value resulting from said step of comparing; and

11 assigning to said meaningful region a particular prototype color name corresponding to
12 said closest match value.

13 30. (original) A method as recited in claim 29, further comprising forming said vocabulary of
14 color names, including the steps of:

15 obtaining at least one general set of essential color names, each essential color name
16 having a corresponding color value;

17 wherein each color name includes a hue descriptor, brightness modifier, and saturation
18 modifier; and

19 selecting a subset of said at least one general set in meeting an application desire for said
20 vocabulary of color names.

21 31. (currently amended) A method as recited in claim 16, having at least one limitation taken
22 from a group of limitations consisting of:

23 wherein the step of using includes:

24 providing a set of rules defining accuracy levels in color naming; †

25 selecting an accuracy level meeting an application desire, † and

1 computing a histogram of color names for said scene, for said selected accuracy level;

2 further comprising forming said rules, includes the steps of:

3 obtaining a set of accuracy levels describing human behavior in color naming, and

4 deriving rules whereby color names and each accuracy level include at least one of: a hue

5 descriptor, a combination of brightness modifiers, and a saturation modifier;

6 wherein the set of accuracy levels is determined employing subjective experiments modeling

7 human behavior in color naming;

8 wherein the step of computing a histogram of color names for said scene includes:

9 determining color names present in said scene,

10 computing a total area for each said color name,

11 discarding color names not meeting an area criterion, and

12 combining color names according to said rule for said selected accuracy level; and

13 further comprising :

14 providing color names for objects in said scene; and

15 pointing out examples of named color in said scene.

16 32-35 (canceled)

17 36. (original) A method comprising computing a simplified representation of a scene consistent
18 with human observation of said scene, including the steps of:

19 applying chromatic transformation to accommodate for different illumination conditions;

20 labeling pixels in said scene into different pixel types;

21 performing adaptive smoothing of said image where the amount of smoothing around
22 each pixel depends on the type of said pixel;

23 determining perceptually significant pixels and perceptually insignificant pixels; and

1 reapplying chromatic transformation to preserve the color appearance to the human
2 observer;

3 37. (original) An article of manufacture comprising a computer usable medium having computer
4 readable program code means embodied therein for causing provision of a description of a color
5 composition in a scene, the computer readable program code means in said article of manufacture
6 comprising computer readable program code means for causing a computer to effect the steps of
7 claim 15.

8 38. (original) A program storage device readable by machine, tangibly embodying a program of
9 instructions executable by the machine to perform method steps for providing a description of a
10 color composition in a scene, said method steps comprising the steps of claim 15.

11 39. (original) An article of manufacture comprising a computer usable medium having computer
12 readable program code means embodied therein for causing provision of a description of a color
13 composition in a scene, the computer readable program code means in said article of manufacture
14 comprising computer readable program code means for causing a computer to effect the steps of
15 claim 36.

16 40. (original) A program storage device readable by machine, tangibly embodying a program of
17 instructions executable by the machine to perform method steps for providing a description of a
18 color composition in a scene, said method steps comprising the steps of claim 36. (original)